

QUEST

ADVENTURES IN THE WORLD OF SCIENCE

SCIENCE OF SOUND

21

14 March

**FACT FILES ON:**

- ▶ 'Seeing' with sound
- ▶ How we hear
- ▶ Ultrasound
- ▶ Pop videos
- ▶ The recording studio
- ▶ Sound energy
- ▶ Synthesizers

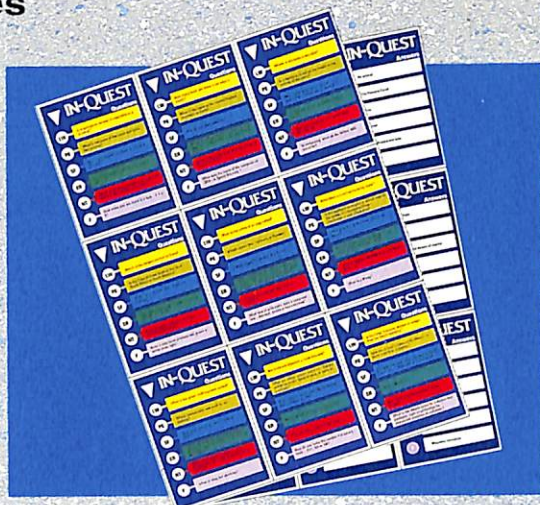
GIANT POSTER**MORE Q&A CARDS****INDEX TO VOLUME 1****THREE PROJECTS**

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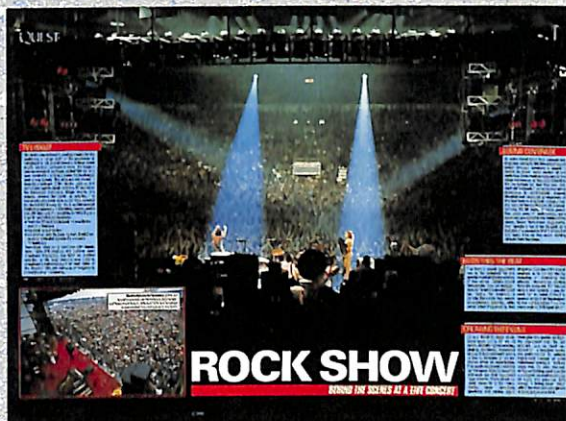
**FULLY
SOR**

INSIDE THIS PACK

- The decibel scale ► Making music ► Echo location ► Promo videos ► Synthetic sound ► Sine waves ► Breaking glass ► Sound vibrations ► Harmonics ► Recording songs ► Sound waves



In-Quest question and answer cards



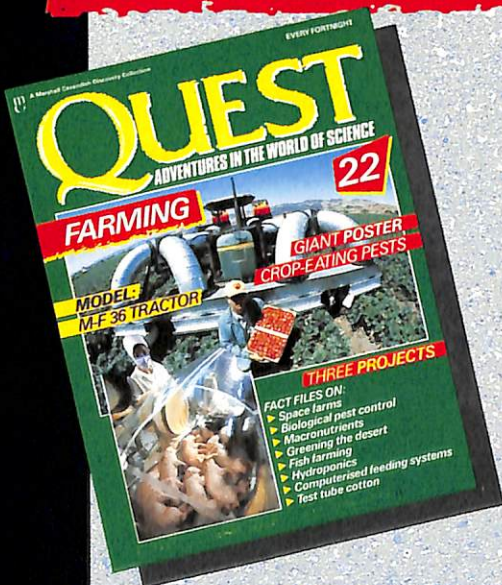
POSTER
Rock show

PROJECT SHEET

- Make a telephone
- See sound in action'
- Play a water xylophone



COMING IN QUEST 22 FARMING



MODEL
M-F36 tractor

FACT FILES INCLUDE:

- Factory farming
- Biospheres
- Pest control
- Hydroponics
- Food from the sea
- Cash crops
- The Green Revolution



POSTER
The evil weevil



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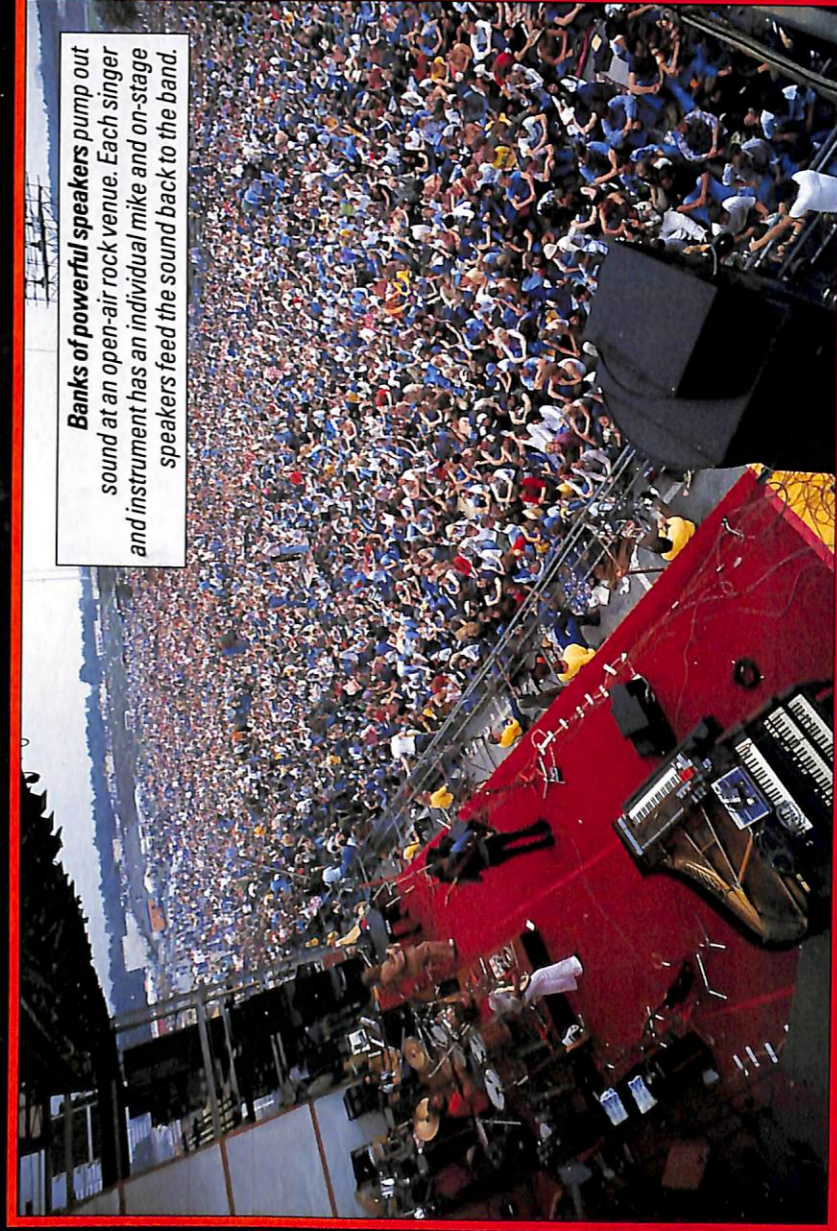


TV LINKUP

While the musical event is being created for the audience, a large staff of TV engineers is relaying it to millions of viewers. A large event might rate four cameras to cover the stage – two on wheeled carriages called 'dollies' and two handheld – and two more for backstage and arena events. The pictures are mixed in outside-broadcast (OB) trucks outside the venue and sent by landline to the TV studios to be broadcast nationally. Major events are relayed around the world by satellite. The complexity of a satellite relay can be illustrated by the UK-US link-up for the Live Aid concert held simultaneously in Wembley, London, and in the JFK Stadium, Philadelphia, in 1985. Signals from Britain followed this route:

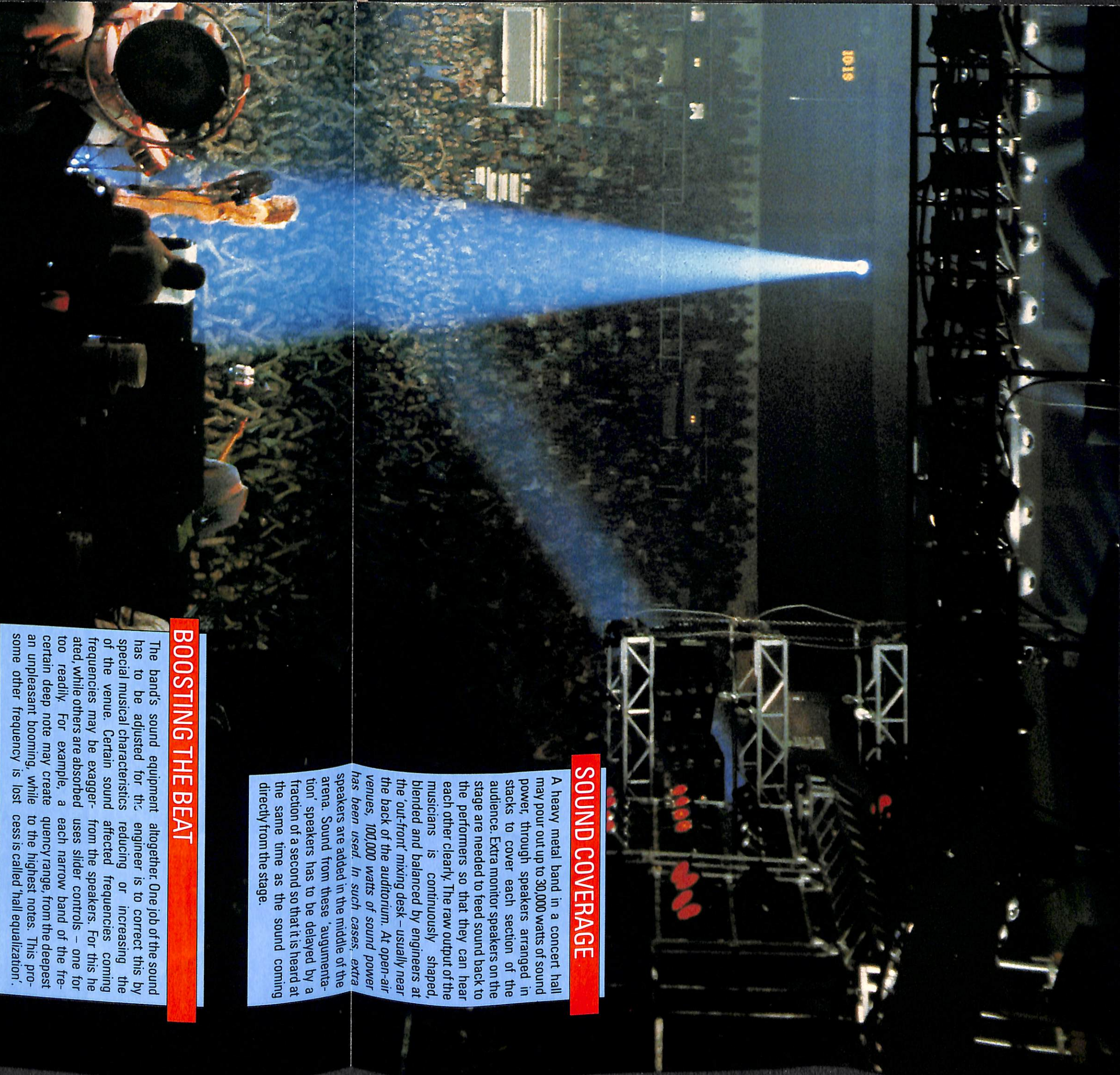
- From the TV studios via landline to an Earth station in Cornwall
 - Via satellite to America
 - Via another satellite (serving the US only) to a transportable dish outside the venue in Philadelphia
- From there, after being combined with signals from inside JFK stadium, the pictures were broadcast throughout the USA by another satellite. In this way viewers saw pictures broadcast simultaneously from both sides of the Atlantic. Similarly complex arrangements linked the other continents.

Thanks to International Musician for assistance with information.



Banks of powerful speakers pump out sound at an open-air rock venue. Each singer and instrument has an individual mike and on-stage speakers feed the sound back to the band.

Photo: Andy Redburns Stephen Morley/Redburns



SOUND COVERAGE

A heavy metal band in a concert hall may pour out up to 30,000 watts of sound power, through speakers arranged in stacks to cover each section of the audience. Extra monitor speakers on the stage are needed to feed sound back to the performers so that they can hear each other clearly. The raw output of the musicians is continuously shaped, blended and balanced by engineers at the 'out-front' mixing desk – usually near the back of the auditorium. At open-air venues, 100,000 watts of sound power has been used. In such cases, extra speakers are added in the middle of the arena. Sound from these 'augmentation' speakers has to be delayed by a fraction of a second so that it is heard at the same time as the sound coming directly from the stage.

BOOSTING THE BEAT

The band's sound equipment altogether. One job of the sound has to be adjusted for the engineer is to correct this by special musical characteristics reducing or increasing the of the venue. Certain sound affected frequencies coming frequencies may be exaggerated from the speakers. For this he ated, while others are absorbed uses slider controls – one for too readily. For example, a each narrow band of the frequency range, from the deepest an unpleasant booming, while to the highest notes. This process is called 'hall equalization'.

CREATING THE EVENT

On a brilliantly lit stage, musicians pour out a torrent of sound, electrifying the swaying, singing audience, thousands strong. A rock concert like this is the culmination of an immense effort of organization. The band's engineers check the performance area in advance and work out their equipment requirements. Fleets of articulated lorries ferry the instruments, mikes, amplifiers, speakers and mixing equipment, plus any specialized lighting equipment that the act requires. Just as much coordination is required during the performance. To achieve high-speed changes at major multi-band events, a revolving stage may be used: the currently performing band is on the visible part; on another part, out of sight, the previous act's set-up is being taken down, while the next act's equipment is being put up on a third.

SHOW

BEHIND THE SCENES AT A LIVE CONCERT

DATAQUEST

TIME: INTERNATIONAL TIMES

Data contingent upon it being midday in London.
No allowance has been made for summer time;*
this normally adds one hour to time shown.

Country	City	Time	Country	City	Time
Argentina	Buenos Aires	0900	Japan	Tokyo	2100
Australia	Sydney	2130	Kenya	Nairobi	1500
Bahamas	Nassau	0700	Lebanon	Beirut	1400
Brazil	São Paulo	0800	Nigeria	Lagos	1300
Canada	Montreal	0700	Pakistan	Karachi	1700
China	Beijing	2000	Thailand	Bangkok	1900
Egypt	Cairo	1400	Turkey	Istanbul	1500
India	Bombay	1730	United Arab Emirates	Abu Dhabi	1600
Indonesia	Jakarta	1900	USA	Los Angeles	0400
Jamaica	Kingston	0700	USA	New York	0700

*Summer time in Britain runs from last Sunday in March to 4th Sunday in October.

WATER: MAJOR WATERFALLS OF THE WORLD

GREATEST (VOLUME OF WATER)

Waterfall	River and Location	Average Flow cubic metres per second	Height metres
Sete Quedas	Paraná River, Brazil-Paraguay	13,310	65
Khone	Mekong River, Cambodia-Laos	11,610	21
Niagara	Niagara River, Canada-USA	6,000	57
Grande	Uruguay River, Argentina-Uruguay	3,000	23
Urubupunga	Paraná River, Brazil	2,750	9
Iguaçu	Iguaçu River, Argentina-Brazil	1,700	70
Marimbondo	Grande River, Brazil	1,500	35
Victoria	Zambezi River, Zimbabwe-Zambia	1,090	92
Churchill	Churchill River, Canada	991	75
Paulo Alfonso	São Francisco River, Brazil	700	80

HIGHEST

Waterfall	Location	Height metres
Angel	Venezuela	807
Itatinga	Brazil	628
Cuquenán	Guyana-Venezuela	610
Ormeli	Norway	563
Tysse	Norway	533
Pilao	Brazil	524
Ribbon	USA	491
Vestre Mardola	Norway	468
Roraima	Guyana	457

MUSIC: INSTRUMENTS OF THE ORCHESTRA

Instrument	Type	Country of Origin	First Orchestral Use
Piccolo	Woodwind	Italy	1717
Cymbals	Percussion	Turkey	1680
Trumpet	Brass	Not known	1800
Glockenspiel	Percussion	Italy (Rome)	1739
Harp	Strings	Not known	1600
Triangle	Percussion	Turkey	1774
Bass Drum	Percussion	Ancient Orient	1748
Vibraphone	Keyboard	Not known-USA?	1934
Viola	Strings	France	1600
Bassoon	Woodwind	Italy	1619
Tambourine	Percussion	Middle East	1820
Xylophone	Percussion	Not known	1873
Violin	Strings	Italy	1600
Kettle Drum (Timpani)	Percussion	Ancient Orient	1607
Double bass	Strings	France	1600
Tuba	Brass	Germany	1830
Clarinet	Woodwind	England	1726
Cor Anglais	Woodwind	England	1760
Flute	Woodwind	Not known	1672
Snare Drum	Percussion	Not known	1749
Cello	Strings	Italy	1600
Oboe	Woodwind	France	1600
French Horn	Brass	France	1650
Trombone	Brass	Italy	1607



PROJECTS

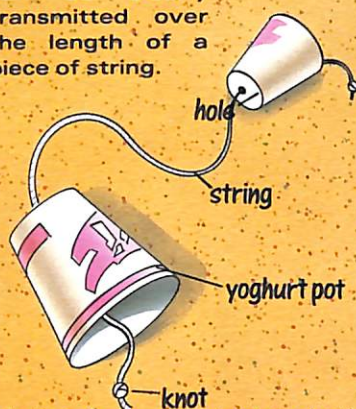
SOUND

- Make a telephone from two yoghurt pots and a piece of string.
- How can you make a xylophone from some glass bottles and water?
- Discover how to see sound with a simple drum.

MAKE A TELEPHONE

1 2 3 4 5

Sound vibrations can be clearly transmitted over the length of a piece of string.



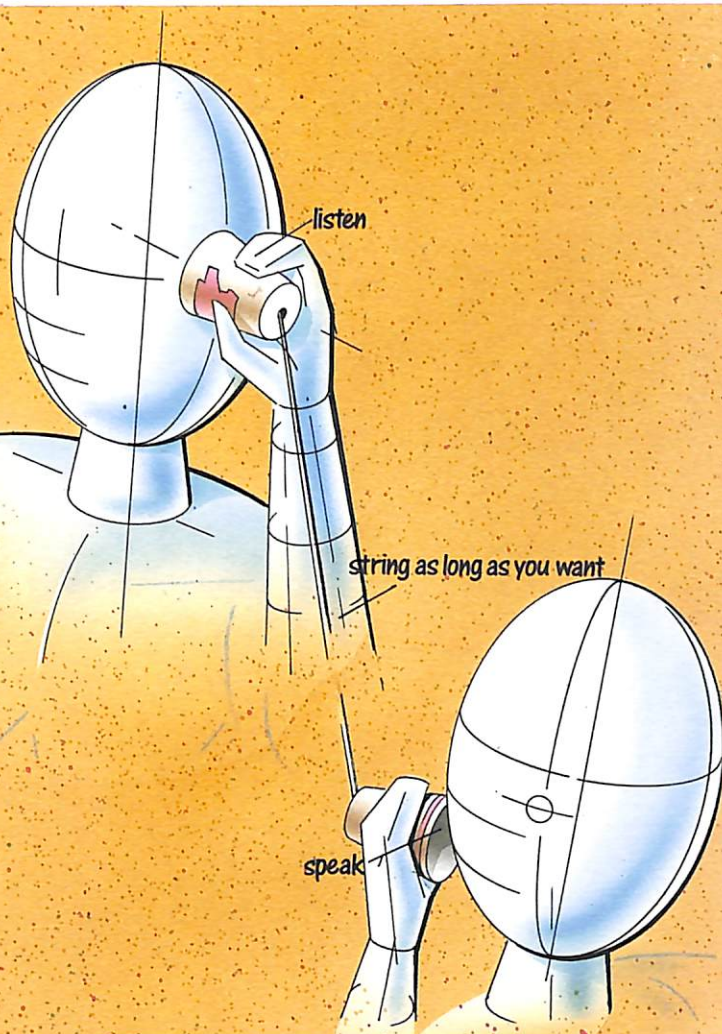
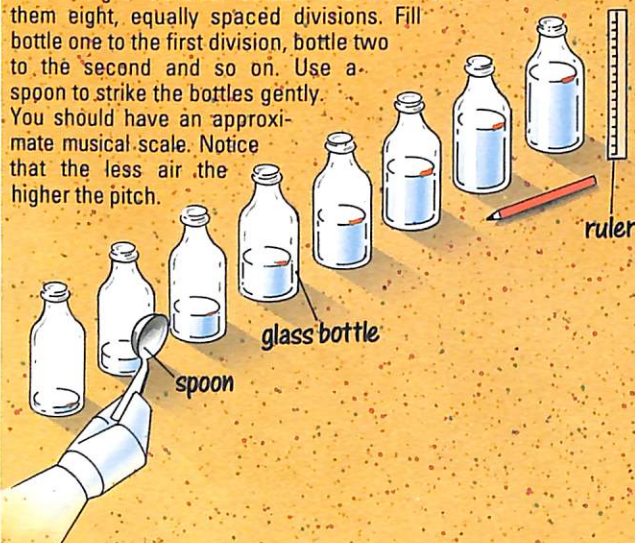
Take two plastic yoghurt pots and a thin piece of string about ten metres long. Punch a small hole in the centre of the bottom of the pots with a skewer or bradawl. Thread the string through the hole, and into one of the pots then knot the end several times so that the string cannot pull back through the hole. Repeat with the other pot. Take the telephone outside and, keeping the string taut, speak into your pot while your partner listens to his or hers. You will be able to converse quite easily or even sing through the telephone.

A WATER XYLOPHONE

1 2 3 4 5

Music depends on air vibrations. See what happens when you vary the amount of air.

Obtain eight identical bottles and mark on them eight, equally spaced divisions. Fill bottle one to the first division, bottle two to the second and so on. Use a spoon to strike the bottles gently. You should have an approximate musical scale. Notice that the less air the higher the pitch.



SEEING SOUND

2 3 4 5

Sound is an energy force that is produced, transmitted and heard by vibrations. Although normally invisible, you can see the vibrations.

Take a thin plastic bag, a big sweet tin or glass mixing bowl, a rubber band and some grains of rice, sugar or small pieces of screwed up paper. Cut the bag along one side and the bottom then spread it tightly over the top of the tin or bowl and secure it with the rubber band. Sprinkle the rice, sugar or paper on top of the drum. Tap the drum with a spoon and you will see the grains or paper jump with the vibrations.



PROJECT INFORMATION

Each **QUEST** project has its own difficulty rating: 1 very simple, 2 simple, 3 intermediate, 4 advanced, 5 complicated.

Every care has been taken to ensure projects are as safe as possible. However, parents should supervise all projects. The publisher can accept no liability for any injury.

WARNING!